

METEORS.

Meteors were observed as follows:

1st, Crete, Nebr. 2d, Cedar Rapids, Iowa. 3d, Cedar Rapids, Iowa; Woodstock, Md.; Utica, N. Y. 4th, Lead Hill, Ark.; Fort Maginnis, Mont. 5th, Vevay, Ind.; Cleburne, Tex. 6th, Boise City, Idaho; Nashua, N. H.; Clayton and Dover, N. J. 7th, Fort Sully, Dak.; Humphrey, N. Y. 8th, Fort Sully, Dak.; Utica, N. Y. 9th, Cedar Keys, Fla.; Cedar Rapids, Iowa. 10th, Lead Hill, Ark.; Fort Sully, Dak.; Cairo, Ill.; Woodstock, Md.; Crete, Nebr.; Stateburg, S. C.; Cleburne, Tex. 11th, Fort Sully, Dak.; Vevay, Ind.; Wakefield, Kans.; Wauseon, Ohio. 12th, Cedar Keys, Fla.; Savannah, Ga.; Wakefield, Kans.; Wauseon, Ohio. 13th, Fort Sully, Dak.; Wilson, Kans.; Biloxi, Miss.; Beverly, N. J. 14th, Lead Hill, Ark.; Fort Sully, Dak. 15th, Woodstock, Md.; Springfield, Mo. 16th, Yuma, Ariz.; Fort Sully, Dak.; Vevay, Ind.; Yates Centre, Kans.; Egg Harbor City, N. J.; Yaquina Light House, Oregon. 17th, Yuma, Ariz.; Vevay, Ind.; Dover and Egg Harbor City, N. J.; Quakertown, Pa.; New Ulm, Tex. 18th, Bar Harbor, Me.; Taunton, Mass.; Ardenia and Utica, N. Y. 19th, Moorhead, Minn.; Wakefield, Kans. 22d, Taunton, Mass.; Cedar Spring, S. C.; New Ulm, Tex. 25th, Savannah, Ga. 27th, Utica, N. Y. 29th and 30th, Humphrey, N. Y.

MIGRATION OF BIRDS.

Geese flying southward.—Red Bluff, Cal., 1st to 4th, 6th, 12th, 15th; Fort Sully, Dak., 3d; Fort Sill, Ind. T., 17th, 26th; Fort Madison, Iowa, 14th; Globe, Kans., 4th, 8th; Wellington, Kans., 4th; Yates Centre, Kans., 24th; Shreveport, La., 17th;

Somerset, Mass., 24th, 25th; Mottville, Mich., 13th, 14th; Forest Park, Mo., 24th; Brownville, Nebr., 27th; North Platte, Nebr., 4th; Manchester, N. H., 25th; Boyd's Corners, N. Y., 26th; Palermo, N. Y., 1st, 6th; Albany, Oregon, 5th, 13th, 14th; East Portland, Oregon, 16th; Linkville, Oregon, 1st, 2d, 7th to 16th, 20th, 23d, 24th to 29th; Roseburg, Oregon, 1st, 5th, 11th, 13th, 14th; Austin, Tenn., 13th; Corsicana and Fort Elliott, Tex., 4th; Palestine, Tex., 9th; Green Bay, Wis., 23d.

Geese flying northward.—Fort Madison, Iowa, 15th, 23d; North Platte, Nebr., 3d; East Portland, Oregon, 15th.

Ducks flying southward.—Duke, Fla., and Springfield, Mo., 29th; Green Bay, Wis., 25th.

MIRAGE.

Mirages occurred as follows: Yuma, Ariz., 6th, 8th; New London, Conn., 29th, 30th; Parkston, Dak., 11th, 16th, 21st; Webster, Dak., 11th, 15th, 27th; Cedar Keys, Fla., 10th, 11th; Marquette, Nebr., 1st, 3d, 10th to 12th, 28th; Galveston, Tex., 1st, 2d.

SAND STORMS.

Forest Park (near Saint Louis), Mo.: a severe sand storm prevailed all day of the 19th, the wind attained a maximum velocity of sixty miles per hour.

Sand storms also occurred as follows: Willcox, Ariz., and Keeler, Cal., 10th.

SUN SPOTS.

Mr. H. D. Govey, North Lewisburg, Champaign Co., Ohio, observed sun spots as follows: 5th, 6th, 12th to 17th.

VERIFICATIONS.

INDICATIONS FOR 33 HOURS IN ADVANCE.

The detailed comparison of the tri-daily indications for November, 1887, with the telegraphic reports for the succeeding thirty-three hours, shows the general average percentage of verifications to be 81.42. The percentages for the different elements are: Weather, 86.09; wind, 78.50; temperature, 76.31. By states, etc., the percentages are: For Maine, 80.30; New Hampshire, 78.90; Vermont, 78.00; Massachusetts, 80.57; Rhode Island, 81.10; Connecticut, 82.87; eastern New York, 84.00; western New York, 77.53; eastern Pennsylvania, 80.90; western Pennsylvania, 80.97; New Jersey, 80.77; Delaware, 80.73; Maryland, 84.23; District of Columbia, 80.70; Virginia, 83.77; North Carolina, 83.03; South Carolina, 82.87; Georgia, 83.93; eastern Florida, 81.87; western Florida, 78.20; Alabama, 81.50; Mississippi, 85.62; Louisiana, 82.85; eastern Texas, 81.35; Arkansas, 84.10; Tennessee, 84.03; Kentucky, 83.17; Ohio, 80.53; West Virginia, 83.97; Indiana, 82.17; Illinois, 82.43; lower Michigan, 74.00; upper Michigan, 75.78; Wisconsin, 80.14; *Minnesota, 70.67; Iowa, 82.00; Kansas, 85.57; Nebraska, 77.53; Missouri, 84.17; Colorado, 80.21; *eastern Dakota, 72.52; *southern California, 76.18; *northern California, 80.32; *Oregon, 70.80; *Washington, 70.83.

The predictions for all districts east of the Rocky Mountains, for November, 1887, were made by 1st Lieutenant H. H. C. Dunwoody, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant, except those for Minnesota and eastern Dakota, which were made at Saint Paul, Minn., by 1st Lieutenant Thomas M. Woodruff, 5th Infantry, U. S. Army, Acting Signal Officer and Assistant, and those for the Pacific coast districts, were made at San Francisco, Cal., by 2d Lieutenant J. E. Maxfield, Signal Corps, Assistant; the verifications for all districts were determined by 1st Lieutenant Robert Craig, 4th Artillery, U. S. Army, Acting Signal Officer and Assistant.

CAUTIONARY SIGNALS.

Of the total number of cautionary and storm signals ordered

*In determining the general average percentage and the percentages for the different elements, Minnesota, eastern Dakota, and the Pacific coast states have not been included.

during November, 1887, it was practicable to determine the justification or failure of one hundred and nine; justified, eighty-nine, or 81.65 per cent. Of the above, seventy-six were ordered for cautionary signals; number justified, sixty-three, or 82.29 per cent. Thirty-three storm signals were ordered; number justified, twenty-six, or 78.79 per cent. Total number of direction signals ordered, ninety-four; justified, ninety-one, or 96.81 per cent. Number of signals ordered for easterly winds, eighteen; justified, seventeen, or 94.44 per cent. Number of signals ordered for westerly winds, seventy-six; justified, seventy-four, or 97.37 per cent. Number of storms without signals, eight. Number of signals ordered late, *i. e.*, after justifying velocity had begun, fourteen, or 12.84 per cent.

COLD-WAVE SIGNALS.

Total number of cold-wave signals ordered, one hundred and ninety-one; justified, one hundred and fifty-three, or 80.10 per cent. Eight cold-wave signals were ordered during the month by the Signal Service Officer at Saint Paul, Minn., of which, seven, or 87.50 per cent., were justified.

LOCAL VERIFICATIONS.

The following is from the report of the "Michigan State Weather Service" for November, 1887:

Weather and temperature signals are now displayed in one hundred and thirty-eight towns in the state, and on the baggage-cars of twenty-six trains on eight principal railroads of the state.

The percentage of verification of weather signals for November is as follows (the verification is taken from reports of displaymen furnished this office monthly): temperature, 82.2 per cent.; weather, 85.4 per cent.; temperature and weather, 83.8 per cent.

The percentage of verification of weather predictions for November on the D., G. H., and M. R'y., is 84.3 for weather and 86.7 for temperature; on the C. & G. T. R'y., weather, 79.8, and temperature, 76.3; P. H. & N. W. R'y., weather, 81.7, and temperature, 79.7; M. C. R'y., for weather, 80.3, and for temperature, 84.0; G. R. & I. R'y., weather, 80.0, and temperature, 77.7; C. & W. M. R'y., weather, 82.8, and temperature, 80.0.

The following is from the November, 1887, report of the "South Carolina Weather Service."

The percentage of the verification of the weather and temperature predictions for the state was: for weather, 85.2 per cent.; temperature, 89.4 per cent. per cent.

The following is from the "Tennessee State Board of Health Bulletin" for November, 1887:

The percentage of verification of weather and temperature predictions, furnished daily from the Signal Office at Washington to the various stations in the state during the month, was for the state: weather, 92.3 per cent.; and temperature, 85.9 per cent.

ERRATA.

October, 1887, REVIEW, on page 281, in the table of "Deviations from the average precipitation," the heading of the third column, Total for October, 1877, should read Total for October, 1887. Same REVIEW, on page 295, in the "Table of miscellaneous meteorological data," in the column of elevations above sea-level, Tatoosh Island, 860 feet, should read 86 feet.

STATE WEATHER SERVICES.

The following extracts are republished from reports for November, 1887, of the directors of the various state weather services:

The "Alabama Weather Service," P. H. Mell, jr., of the Agricultural and Mechanical College, Auburn, director:

The weather during most of the month has been pleasant, and unusually mild for a winter season. The condition of the atmosphere has been fine for gathering the cotton remaining in the fields, and specially favorable for all the work required on the farm. The dry season has kept the roads in good traveling condition throughout the state.

Although the average temperature for the month was 2° 5 below the normal, still there were so many mild periods that the casual observer might overlook the few cold days that reduced the temperature below the normal. Killing frosts occurred in middle and south Alabama on the mornings of the 21st and 22d; in the extreme northern portions of the state killing frosts came as early as the 1st and 2d. There were two severe cold waves that swept across the state, the first on the 20th, the second on the 28th. The first was the most severe.

The rainfall was 3.28 inches below the normal.

The autumn just closed gives a temperature 3° 4 below the normal, the average for the period being 62° 9. There was also quite a deficiency in the amount of rainfall during the three months. The total precipitation was 7.48 inches; 3.91 inches below the normal.

Summary.

Atmospheric pressure (in inches).—Monthly mean, 30.164; maximum observed, 30.68, at Auburn, on the 30th; minimum observed, 29.60, at Chattanooga, on the 19th; range for state, 1.08.

Temperature (in degrees Fahr.).—Monthly mean, 52° 9; highest monthly mean, 59°, at Oswichee; lowest monthly mean, 42° 1, at Demopolis; maximum, 84°, at Union Springs, on 1st; minimum, 9°, at Gadsden, on the 21st; range for state, 75°; greatest local monthly range, 69°, at Gadsden; least local monthly range, 37°, at Fayette.

Precipitation, including melted snow (in inches).—Average for the state, 1.12; greatest, 6.00, at Fayette; least, inappreciable, at Newton.

Winds.—Prevailing direction, northeast.

The "Monthly Review of the Illinois Weather Service," Col. Charles F. Mills, director:

The drought of this remarkable season continued until the 23d, when copious rains set in and continued at intervals until the morning of the 27th, thereby removing the water famine that seemed so imminent. No rain fell until the 9th, when there was slight rain over the greater part of the state—more copious in the northern counties than either the central or southern. On the 19th there was a considerable snowfall in the northern counties, with light rain in a few of the central, but none in the southern. Although rain fell on fewer days in the southern than in the northern division, the precipitation in the latter was only one-third that of the former. Still considerable rain fell all over the state, but in some places there were remarkable downpours for this period of the year. At Vandalia, 5 inches fell on the 26th; Greenville, 3.40; Mattoon, 5.11; Pana, 3.25; Jordan's Grove, 3.25; Irishtown, 2.63; Saint Louis, 2.32; and Flora, 2.29. The heaviest rainfall of the month was at Vandalia, 8.95 inches, nearly all of which fell on three days; the least was 0.70 of an inch, at Ashland.

There was hardly any precipitation in this state until the 23d, when light rain began and continued at intervals until the 26th, when it changed to snow before the advancing "cold wave," and ended on the morning of the 27th. This rain was the first break in the drought of the season and has been of considerable benefit generally, especially to growing wheat and the wells that have been so long dry. Still the relief is only temporary, and much more is needed.

A record at this office of the annual rainfall in the state since 1840, a period of forty-six (?) years, shows that the average is 38.41 inches. The present year up to date falls about 18 inches below this; consequently, this year will be remarkable as the driest on record, for there is no probability that December will make up beyond a small fraction of this deficiency. There have been other years in which drought prevailed since the record commenced, but none anywhere approaching this. The greatest rainfall recorded since 1840 was 48.49 inches, in 1852, which was 10.17 above the general average of forty-six years; 1844 was next, with 48.17 inches; 1851 had 46.91; and 1862 had 46.30. The driest year was 1867, with 29.53 inches, which was nearly nine inches below the general level. Other dry years were 1870, with 29.90 inches; 1854, with 31.13; and 1856, with 31.89. The present year will therefore in all probability, fall five or six inches below the lowest on record.

The average temperature for November, 40° 2, was one degree above the average of twelve years, and 2° 5 below the mean of November 1882, which was the highest during that period. The average for the northern division

was 36° 2; for the central, 40° 4, and for the southern, 44° 1. The warmest day was the 3d, and the coldest was the 28th. On that day the temperature was recorded below zero in nineteen counties in the northern division, while three others recorded zero.

The "Indiana Weather Service," Prof. H. A. Huston, of Purdue University, Lafayette, director:

The mean temperature was slightly above the normal for six years, and slightly below the normal for fifteen years. Great changes from a higher to a lower occurred about the 20th and 28th, while the highest temperature everywhere in the state occurred on the 3d. The precipitation during the month was slightly in excess. The drought was ended about the 23d by steady rains, followed by snow, falling everywhere till the 27th; the deficiency since January 1, 1887, which on the 22d had reached 15.38 inches, was considerably lessened thereby. Hoar frost was very frequent, and snow fell everywhere in the state near the end of the month.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 39.4; highest monthly mean, 49.3, at Worthington; lowest monthly mean, 34.4, at Maury; maximum, 80.0, at Marengo on the 3d; minimum, -7.0, at Worthington, on the 28th; range for state, 68.3; greatest local monthly range, 82.0, at Worthington, least local monthly range, 55.0, at Angola.

Precipitation, including melted snow (in inches).—Average for the state, 3.97; greatest, 6.90, at Marengo; least, 1.43, at Crawfordsville.

Wind.—Prevailing direction, southwest.

The "Kansas Weather Service," Prof. J. T. Lovewell, Topeka, director:

The temperature for this month is from 1° to 3° above the normal. Two warm and two cold waves have passed over the state during the month. The precipitation, as usual for the season, has been light and below the normal for the month, the greater amount fell during the storm of the 7-9th, and the balance from the 23d to the 26th.

Summary.

Temperature (in degrees Fahr.).—Monthly mean, 41.5; highest monthly mean, 49, at Sedan; lowest monthly mean, 35, at Eustis; maximum, 87, at Lebo, on the 3d; minimum, -19, at Eustis, on the 27th; range for state, 106; greatest local monthly range, 100, at Eustis; least local monthly range, 75, at Sedan; greatest daily range, 52, at Lebo, on the 3d; least daily range, 3, at Leavenworth, on the 25th.

Precipitation, including melted snow (in inches).—Average for the state, .90; greatest, 1.40, at Cawker City and Lawrence; least, .24, at Dodge City.

Wind.—Prevailing direction, south.

The "Louisiana State Weather Service," in charge of R. E. Kerkam, Sergeant, Signal Corps, at New Orleans:

The mean temperature of the state for November, 1887, was 57° 5, which was 0° 3 above the normal for the month. The means of the northern section, 55° 7, and of the southern section, 59° 3, were respectively 1° 3 below and 1° 8 above the November normals for those sections. The daily mean temperature of the state ranged from 56° to 67° from the 1st to the 18th of the month, and fell from 67° on the 16th to 39° on the 20th, when it rose to 70° on the 26th, falling to 40° on the 28th; the month closing with a daily mean of 50°. With the exception of the two cold waves mentioned the past month was remarkably mild and pleasant.

The maximum temperature observed, 81°, occurred in Madison parish on the 15th, and the range of the maximum temperatures reported was only 5°, the lowest, 76°, being reported from Saint Tammany parish on the 8th, 24th, and 26th. The minimum temperatures were reported on the 21st and 28-29th, and, excepting Novembers of 1877 and 1880, when minimum temperatures of 19° and 18°, respectively, were recorded in Caddo parish, the minimum of the past month is the lowest on record for the state, being 22°, and reported from Delta, Madison parish.

The average precipitation for the state, 1.98 inches, was 2.03 inches below the November normal, and the lowest on record for the month. The extremes of monthly rainfall reported were, 6.45 inches from the 28d to 25th, inclusive, and 0.52 of an inch in Orleans parish. The average number of clear days was 15; fair, 8; cloudy, 7; and on which appreciable precipitation fell, 4. From this it appears that the state received about 10 per cent. more sunshine during the past month than in the average November. The prevailing winds in the northern section were from the south, and in the southern section from the north.